SRI BHAGAWAN MAHAVEER JAIN COLLEGE Vishweshwarapuram, Bangalore. **Mock-1 Examination** – January 2020	**Course:** II PUC **Subject:** Mathematics **Max. Marks:** 100 **Duration:** 3:15

Instructions:

1. **The questions paper has FIVE parts namely A, B, C, D and E.**
2. **Use Graph sheet for LPP problem in Part-E**

PART-A

I Answer ALL the questions **10 x 1 = 10**

1 Give an example of a relation which is symmetric only.

2 Write the range of $f(x) = \sin^{-1} x$ in $[0, 2\pi]$.

3 If A is a square matrix of order 3 and |A| = 4. Find the value of |2A|

4 Define a scalar matrix.

5 Find the derivative of $\sin(x^2+1)$.

6 Evaluate $\int \tan^2(2x)\,dx$.

7 Define collinear vector.

8 Find the direction cosines of a vector $i + 2j + 3k$. .

9 Define the term "constraints" in LPP.

10 If A and B are independent events with P(A) = 0.3, P(B)=0.4. Find the $P(A \cap B)$

PART-B

II Answer any TEN questions: **10 x 2 = 20**

11 Find gof and fog if f: $R \to R$ and g : $R \to R$ defined, by f(x) = cosx and g (x) = $3x^2$.

12 Write in the simplest form $\tan^{-1}\left[\sqrt{\frac{1-\cos x}{1+\cos x}}\right]$.

13 Prove that $\sin^{-1}(x) + \cos^{-1}(x) = \frac{\pi}{2}$; $x \in [-1, 1]$.

14 Prove that the value of a determinant remains unchanged if its rows or columns are interchanged by considering a 3rd order determinant.

15 Find $\frac{dy}{dx}$ if $\sin^2 x + \cos^2 y = k$ with 'k' is a constant.

16 Differentiate $\left(x + \frac{1}{x}\right)^x$ with respect to x.

17 Find the slope of the tangent to the curve $y = x^2 - 3x + 2$ at the point whose x – constant is 3.

18 Evaluate $\int \frac{\cos 2x - \cos 2\alpha}{\cos x - \cos \alpha} dx$.

19 Evaluate $\int \frac{e^{2x} - 1}{e^{2x} + 1} dx$.

20 Find the order and degree of the differential equation $\left(\frac{d^2y}{dx^2}\right)^3 + \left(\frac{dy}{dx}\right)^2 + Sin\left(\frac{dy}{dx}\right) = 1$.

21 If $\vec{a} = 5i - j - 3k$ and $\vec{b} = i + 3j - 5k$. Show that $\vec{a} + \vec{b}$ and $\vec{a} - \vec{b}$ are perpendicular to each other.

22 Find $|\vec{x}|$, if for the unit vector $\vec{a}$, $(\vec{x} - \vec{a}).(\vec{x} + \vec{a}) = 12$.

23 Find the equation of the plane through the intersection of the planes 3x – y + 2z - 4 = 0 and x + y +z - 2 = 0 and the point (2,2,1).

24 If the probability distribution of X is

X	0	1	2	3	4
P(x)	0.1	k	2k	2k	k

Find the value of k

PART-C

III Answer any TEN questions: **10 x 3 = 30**

25 Show that the relation R in the set of integers given by R = {(a, b) : 5 divides a – b} is an equivalence relation.

26 Find the value of $\tan \frac{1}{2}\left[\sin^{-1}\left(\frac{2x}{1+x^2}\right) + \cos^{-1}\left(\frac{1-y^2}{1+y^2}\right)\right]$.

27 Express the matrix A = $\begin{bmatrix} 3 & 5 \\ -1 & -1 \end{bmatrix}$ as a sum of symmetric and skew-symmetric matrix.

28 Find $\frac{dy}{dx}$ if $x = a[\text{Cos}\theta + \theta\text{Sin}\theta]$; $y = a[\text{Sin}\theta - \theta\text{Cos}\theta]$.

29 Find the absolute maximum and absolute minimum value of the function $h(x) = \sin x + \cos$; $x \in [0, \pi]$.

30 Find the interval in which the function f is given by $f(x) = 2x^3 - 3x^2 - 36x + 7$ is strictly increasing.

31 Evaluate : $\int Sin\left(\frac{2\tan^{-1} x}{1+x^2}\right) dx$.

32 Evaluate : $\int_0^2 (x^2 + 1)\, dx$ as a limit of a sum.

33 Find the area of the region bounded by the curve $y^2 = x$ and the line x = 1, x = 4 and the x – axis in the first quadrant.

34 Form the differential equation reprecenting the family of curve y = a sin(x+b) where 'a' and 'b' arbitary constants.

35 Prove that $\left[\vec{a}+\vec{b},\ \vec{b}+\vec{c},\ \vec{c}+\vec{a}\right]=2\left[\vec{a},\ \vec{b},\ \vec{c}\right]$.

36 Find the area of the triangle having vertices A (1, 1, 2) B (2, 3, 5) and C (1, 5, 5) by vector method.

37 Find the distance of a point (2, 5, -7) from the plane $\vec{r}.\left(i-2j-2k\right)=9$.

38 Two cards are drawn successively with replacement from a well shuffled deck of 52 cards. Find the probability distribution of the number of aces.

PART-D

IV Answer any SIX of the following: 6 x 5 = 30

39 Prove that the function f : N→Y defined by f(x) = x^2 where Y = {y : y = x^2, x∈N}is invertible. Also find the inverse of f (x).

40 If $A=\begin{bmatrix}1 & 2 & -3\\ 5 & 0 & 2\\ 1 & -1 & 1\end{bmatrix}$, $B=\begin{bmatrix}3 & -1 & 2\\ 4 & 2 & 5\\ 2 & 0 & 3\end{bmatrix}$, $C=\begin{bmatrix}4 & 1 & 2\\ 0 & 3 & 2\\ 1 & -2 & 3\end{bmatrix}$ compute (i) A + B, (ii) B – C also verify that A + (B – C) = (A + B) – C.

41 Solve by Matrix method

x + y + z = 10
x – y – z = -2
2x + 3y + 4z = 4

42 If e^y (x + 1) = 1 prove that $\frac{d^2y}{dx^2}=\left(\frac{dy}{dx}\right)^2$.

43 A man of height 2 meters walk at a uniform speed of 5 km/hr away from a lamp post which is 6 mts high. Find the rate at which the length of his shadow is increasing.

44 Find the integral of $\frac{1}{x^2-a^2}$ with respect to x, and hence evaluate $\int\frac{dx}{3x^2+13x-10}$.

45 Find the area of the region bounded by the parabola y^2 = 4x and the line y = 2x.

46 Find the particular solution of the differential equation $\frac{dy}{dx}+\cot x.y=4x$ cosecx . Given that y = 0, when x = 1.

47 Derive the formula to find the shortest distance between the two skew-lines $\vec{r}=a_1+\lambda b_1$, $\vec{r}=a_2+\mu\vec{b}_2$. in the vector form.

48 Five cards are drawn successively with replacement from a well shuffled deck of 52 cards. What is the probability that (i) All 5 cards are spades, (ii) Only 3 cards are spades, (iii) none of them is spade?

PART-E

V Answer any ONE questions: **10 x 1 = 10**

49 a) Prove that $\int_a^b f(x)\,dx = \int_a^b f(a+b-x)\,dx$ and hence evaluate $\int_{\pi/6}^{\pi/3} \frac{1}{1+\sqrt{\tan x}}\,dx$.

b) Prove that $\begin{vmatrix} a^2+1 & ab & ac \\ ab & b^2+1 & bc \\ ca & cb & c+1 \end{vmatrix} = 1+a^2+b^2+c^2$.

50 a) Minimze and maximize Z = x + 2y subject to the constraints x + 2y ≥100, 2x – y ≤ 0, 2x + y ≤ 200 and x, y ≥ 0 by Graphical method.

b) Determine the value of k if $f(x) = \begin{cases} \frac{k\cos x}{\pi - x} & \text{if } x \neq \pi/2 \\ 3 & \text{if } x = \pi/2 \end{cases}$ is continous at x = $\pi/2$.

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